Analysis of Link Reversal Routing Algorithms for Mobile Ad Hoc Networks

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Abstract

Link reversal (LR) algorithms provide a simple mechanisme for routing in communication networks whose topology is frequently changing, such as in mobile and ad hoc networks. A LR algorithm routes by imposing a direction on each network link such that the resulting graph is destination oriented (DAG). Whenever a node loses routes to the destination, is reacts by reversing some (or all) of its incident links.

This survey presents the worst-case performance analysis of LR algorithms from the excellent work of Costas Busch and Srikanta Tirthapura (*SIAM J. on Computing*, **35**(2):305-326, 2005). The LR algorithms are studied in terms of *work* (number of node reversals) and *time* needed until the algorithm stabilizes to a state in which all the routes are reestablished. The *full reversal* algorithm and the *partial reversal* algorithm are considered.

- The *full reversal* algorithm requires $O(n^2)$ work and time, where n is the number of nodes that have lost routes to the destination. This bound is tight in the worst case.
- The *partial reversal* algorithm requires $O(na^* + n^2)$ work and time, where a^* is a non-negative integral function of the initial state of the network. Further, the *partial reversal* algorithm requires $\Omega(na^* + n^2)$ work and time.
- There is an inherent lower bound on the worst-case performance of LR algorithms: $\Omega(n^2)$. Therefore, surprisingly, the full reversal algorithm is *asymptotically optimal* in the worst-case, while the partial reversal algorithm is *not*; since a^* can be arbitrarily larger than n.

Short Biography of Christian Lavault

Christian Lavault received the Ph.D degree in Mathematics from University Paris 11, Orsay, France, in 1975. He received the Doctor of Philosophy degree (*Thèse d'État*) in Computer Science from the Computing Department at the University Paris 11 in 1987. Currently, he is a full professor at the *Institut Galilée*, University Paris 13, and is director of the OCAD team of the Research Laboratory LIPN (CNRS, UMR 7030).

His research interests include applications of discrete Maths to Computer Science: complexity analysis of algorithms and data structures, analytic combinatorics, distributed computing, wireless communications, sensor networks.